

WHAT IS CLAIMED IS:

1        1.        A device for calculating a total amount of toner consumed from a  
2        toner cartridge, the device comprising:

3                a counter, which obtains a first amount of the toner, which is  
4        consumed in a first region of a recording medium at which a toner image is  
5        formed;

6                a timer, which clocks a time period of which the toner cartridge is in  
7        operation;

8                a storage, which stores in advance a second amount of the toner,  
9        which is consumed in a second region of the recording medium at which the  
10       toner image is not formed, the second amount being associated with the time  
11       period; and

12               a calculator, which adds the second amount to the first amount in  
13       accordance with the clocked time period, in order to obtain the total amount.

1        2.        A device for calculating a total amount of toner consumed from a  
2        toner cartridge, the device comprising:

3                a counter, which obtains a first amount of the toner, which is  
4        consumed in a first region of a recording medium at which a toner image is  
5        formed;

6                a storage, which stores in advance a second amount of the toner,  
7        which is consumed by forming a test image; and

8                a calculator, which adds the second amount to the first amount, in  
9        order to obtain the total amount.

1        3.        A device for calculating a total amount of toner consumed from a  
2        toner cartridge, the device comprising:

3                a counter, which obtains a first amount of the toner, which is  
4        consumed in a first region of a recording medium at which a toner image is  
5        formed;

6                a storage, which stores in advance a second amount of the toner,  
7        which is consumed for a purpose other than the formation of the toner image  
8        on the recording medium; and

9                a calculator, which adds the second amount to the first amount, in  
10       order to obtain the total amount.

1        4.        The device as set forth in claim 3, wherein the second amount of the  
2        toner includes a toner used for forming a registration mark for placing the  
3        recording medium at a predetermined position.

1        5.        The device as set forth in claim 3, wherein the second amount of the  
2        toner includes a toner used for stabilizing vibrations of a cleaning blade  
3        abutted against a toner carrier.

1        6.        A device for calculating a total amount of toner consumed from a  
2        toner cartridge, the device comprising:

3                a counter, which obtains a first amount of the toner, which is  
4        consumed in a first region of a recording medium at which a toner image is  
5        formed;

6           a first storage, which stores in advance a second amount of the toner,  
7    which is consumed for forming a first test image;  
8           a second storage, which stores in advance a third amount of the toner,  
9    which is consumed for forming a second test image; and  
10          a calculator, which adds the second amount and the third amount to  
11   the first amount, in order to obtain the total amount.

1    7.       The device as set forth in claim 6, wherein the first test image is a  
2    gradation image, and the second test image includes at least a solid image.

1    8.       The device as set forth in claim 6, wherein:  
2           the first storage is provided in a first controller which receives an  
3    image signal from an external device; and  
4           the second storage is provided in a second controller which controls  
5    the formation of the toner image based on an instruction from the first  
6    controller.

1    9.       The device as set forth in any one of claims 1 to 3, wherein:  
2           a plurality of colors of toner are used to form the toner image; and  
3           the second amount is individually determined for each of the colors.

1    10.      The device as set forth in claim 6, wherein:  
2           a plurality of colors of toner are used to form the toner image; and  
3           the second amount and the third amount are individually determined  
4   for each of the colors.

1 11. A method for calculating a total amount of toner consumed from a  
2 toner cartridge, the method comprising steps of:  
3 obtaining a first amount of the toner, which is consumed in a first  
4 region of a recording medium at which a toner image is formed;  
5 clocking a time period of which the toner cartridge is in operation;  
6 storing in advance a second amount of the toner, which is consumed  
7 in a second region of the recording medium at which the toner image is not  
8 formed, the second amount being associated with the time period; and  
9 adding the second amount to the first amount in accordance with the  
10 clocked time period, in order to obtain the total amount.

1 12. A method for calculating a total amount of toner consumed from a  
2 toner cartridge, the method comprising steps of:  
3 obtaining a first amount of the toner, which is consumed in a first  
4 region of a recording medium at which a toner image is formed;  
5 storing in advance a second amount of the toner, which is consumed  
6 by forming a test image; and  
7 adding the second amount to the first amount, in order to obtain the  
8 total amount.

1 13. A method for calculating a total amount of toner consumed from a  
2 toner cartridge, the method comprising steps of:  
3 obtaining a first amount of the toner, which is consumed in a first  
4 region of a recording medium at which a toner image is formed;

5           storing in advance a second amount of the toner, which is consumed  
6   for a purpose other than the formation of the toner image on the recording  
7   medium; and  
8           adding the second amount to the first amount, in order to obtain the  
9   total amount.

1   14.     The method as set forth in claim 13, wherein the second amount of  
2   the toner includes a toner used for forming a registration mark for placing the  
3   recording medium at a predetermined position.

1   15.     The method as set forth in claim 13, wherein the second amount of  
2   the toner includes a toner used for stabilizing vibrations of a cleaning blade  
3   abutted against a toner carrier.

1   16.     A method for calculating a total amount of toner consumed from a  
2   toner cartridge, the method comprising steps of:  
3           obtaining a first amount of the toner, which is consumed in a first  
4   region of a recording medium at which a toner image is formed;  
5           storing in advance a second amount of the toner, which is consumed  
6   for forming a first test image;  
7           storing in advance a third amount of the toner, which is consumed for  
8   forming a second test image; and  
9           adding the second amount and the third amount to the first amount, in  
10   order to obtain the total amount.

1        17.        The method as set forth in claim 16, wherein the first test image is a  
2        gradation image, and the second test image includes at least a solid image.

1        18.        The method as set forth in any one of claims 11 to 13, wherein:  
2                a plurality of colors of toner are used to form the toner image; and  
3                the second amount is individually determined for each of the colors.

1        19.        The method as set forth in claim 16, wherein:  
2                a plurality of colors of toner are used to form the toner image; and  
3                the second amount and the third amount are individually determined  
4        for each of the colors.

1        20.        An image forming apparatus, comprising:  
2                the device as set forth in any one of claims 1 to 3 and 6;  
3                a storage, which stores a remaining amount of the toner in the toner  
4        cartridge, the remaining amount is calculated by subtracting the total amount  
5        calculated by the calculator from an initial amount of the toner; and  
6                a judge, which judges a time at which the toner cartridge is replaced,  
7        in a case where the remaining amount becomes a predetermined value or  
8        less.

1        21.        The image forming apparatus as set forth in claim 20, wherein the  
2        predetermined value is selected from a plurality of values one of which is  
3        substantially zero.

1     22.     The image forming apparatus as set forth in claim 20, wherein the  
2     predetermined value is varied in accordance with a rate of an area of the toner  
3     image relative to the recording medium.

1     23.     The image forming apparatus as set forth in claim 20, wherein the  
2     predetermined value is individually determined for each of a plurality of toner  
3     cartridges having different volumes.